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Fiscal Stabilisation in the EMU

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Abstract

This paper analyses the effects of macroeconomic shocks in a monetary union with the aid of a two-country model of the EMU. Our analysis serves two purposes. First, we show how asymmetries between countries might matter in terms of the resulting business cycle fluctuations. More specifically, we do not only allow for country-specific shocks but also for cross-national differences in wage behaviour. Secondly, we show by means of numerical simulations how fiscal policy can be used to dampen business cycle fluctuations in various (a)symmetric settings. We consider two types of fiscal policy, national fiscal stabilisation and stabilisation from a federal system of fiscal transfers between countries, and we derive their welfare implications. The main innovation of the paper is to illustrate how structural differences between countries, e.g. a varying degree of wage rigidity, help to determine the impact of macroeconomic shocks and the effectiveness of fiscal policy. So far, this kind of asymmetry has been given little attention in the literature on fiscal policy in the EMU.

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1. Introduction

On January 1, 1999 the European Union (EU) countries that satisfy the convergence criteria of the Maastricht Treaty on Economic and Monetary Union (EMU) will form a monetary union by adopting a common currency, the Euro, and a common central bank, the European Central Bank (ECB). In its influential study 'One Market, One Money' the European Commission analysed in detail the possible costs and benefits of the EMU. A common currency is expected to entail static and dynamic efficiency gains from the elimination of conversion costs and exchange rate uncertainty in intra-EU trade and investment and from a greater transparency of goods, labour and financial markets in the EU. A common currency is envisaged as a logical extension of the Single Market Program by the European Commission: a common currency without a common market or a common market without a common currency cannot yield the full gains from economic integration in the EU. Therefore, EMU is expected to strongly support the process of economic (and political) integration in the EU. In addition, seigniorage gains may entail if the Euro is widely used in international trade and international reserves outside the EU and the EU could have a stronger bargaining position in international macroeconomic policy coordination. The main drawback of replacing national currencies by a common currency results from the loss of national monetary policy -and particularly the instrument of exchange rate adjustment- as a macroeconomic policy instrument.

Given these alleged benefits of monetary union, the 'optimal currency area' theory focuses on the costs of monetary union and tries to determine whether it is efficient for a country to enter a monetary union or rather to keep its national currency and monetary policy autonomy. More particular, the optimal currency area literature concludes that a national currency remains favourable: (i) the more macroeconomic shocks in a monetary union are asymmetric, (ii) the larger the rigidities in goods and labour markets, (iii) the less is the amount of trade with the other countries of a monetary union, (iv) the lower is labour mobility and (v) the smaller is the automatic stabilisation by federal government spending and taxation.

By now a large literature has developed in which the role of macroeconomic stabilisation policies after the establishment of the EMU is analysed. In these analyses the distinction between symmetric or EMU-wide and asymmetric or country-specific macroeconomic shocks is crucial. Empirical studies indicate that asymmetric shocks are indeed fairly important in the EU and it may even be argued, see for instance Bayoumi and Eichengreen (1996), that these shocks may become even more important in the future in the case of the EU. Moreover, also empirical evidence on substantial goods and labour market rigidities, low labour mobility and a very low amount of automatic stabilisation from federal fiscal policies has been found. Empirical studies on symmetric and asymmetric shocks in the EU include Weber (1991),

Bayoumi and Eichengreen (1993), Bayoumi and Prasad (1995), Christodoulakis, Dimelis and Kollintzas (1995), Helg et al. (1995) and Karras (1996). Most studies find a distinction between a group of 'core' countries whose macroeconomic shocks tend to be more symmetrical, and a group of 'peripheral' countries whose macroeconomic shock are more asymmetric. Labour mobility in the EU has been studied by Decressin and Fatás (1995) and Abraham (1995). The automatic stabilisation from the EU budget was investigated by Goodhart and Smith (1993), von Hagen (1991) and Bayoumi (1994) who all conclude that it is very small.

The loss of national monetary policy autonomy in EMU implies that the adjustment burden from macroeconomic stabilisation in the EU is shifted largely to national fiscal policy, given a setting with an independent price-stability oriented ECB and the absence of a sizeable federal fiscal budget. From that perspective, it might seem counterintuitive that the Maastricht Treaty proposed the 'Excessive Deficit' procedure that should prevent countries from running sustained fiscal deficits. Furthermore, the recently establishes 'Stability Pact' seems to limit the possibility for national governments to implement countercyclical fiscal policies. From the viewpoint of macroeconomic stabilisation this set of fiscal restrictions may turn to be inefficient, in particular in cases where EU countries are hit by prolonged asymmetric shocks in a setting with goods and labour market rigidities, low labour mobility and no automatic stabilisation from federal taxation and spending.

This paper analyses the problem of fiscal stabilisation policy in a two-country model of EMU that features not only the possibility of asymmetric shocks but -and herein lies the main innovation of the paper- also takes into account that the EU countries may feature institutional and structural disparities. An -admittedly stylized- theoretical framework is developed featuring different degrees of symmetry concerning macroeconomic shocks and institutional and structural characteristics. Concerning the latter, we focus on the possibility that EU countries can differ in terms of their wage formation institutions. In our model these differences are reflected in possible differences in the degree of wage indexation. It is a well-established fact that European countries are far from uniform as far as wage flexibility is concerned. Given these two potential sources of asymmetries we show how fiscal flexibility at the national level as well as a system of intra-European fiscal transfers might mitigate the business cycle fluctuations. The idea of a transfer system to stabilise economic fluctuations induced by idiosyncratic shocks under EMU was formulated by van der Ploeg (1991). Subsequent studies on the design of such transfer systems by Italianer and van Heukelen (1993), Mélitz and Vori (1993) and von Hagen and Hammond (1995) further developed this concept.

The paper is organised as follows. Section 2 introduces a stylized two-country model of the

EMU. In section 3 the model is used to simulate the effects of symmetric and asymmetric shocks under various assumptions concerning the degree of wage rigidity. In our simulations we consider three regimes: (i) no fiscal stabilisation at all, (ii) fiscal stabilisation on the national level and (iii) fiscal stabilisation by means of a federal fiscal transfer system. The welfare implications of each regime are also investigated. In section 4 we vary specific parameters of our model to see whether and how this affects our conclusions with respect to the effectiveness of fiscal stabilisation policy. We also formulate the main policy implications that result from the analysis. Section 5 concludes the paper.

2. A Two-Country EMU Model

The analytical model that is used to study fiscal stabilisation in a monetary union is based on the two or more country Mundell-Fleming models that have been widely used to analyse the international transmission of monetary and fiscal policies and problems in international policy coordination, e.g. by Turnovsky (1986), Miller and Williamson (1988), Manasse (1991) and Sheen (1992). Traditionally, numerical simulations with large scale multi-country variants have been widely used for policy analysis. Bryant et al. (1988) have studied the setup and results that are obtained with the aid of such large multi-country models and their use in macroeconomic policy design. Basically, these models are large scale variants of the Mundell-Fleming model. Krugman (1993), moreover, notes that the latter remains “the workhorse of international policy analysis”, despite its obvious limitations due to the lack of explicit microeconomic foundations.

Assume that EMU has been fully implemented, implying that the national central banks are replaced by the ECB and national currencies by a common currency, the Euro. Assume also that there is no labour mobility between both countries. To reduce complexity we ignore the interaction with economies outside the monetary union. We also ignore strategic behaviour among policy makers¹. In order to be able to analyse the effects of fiscal policy in an EMU that features symmetric and asymmetric macroeconomic shocks and possible structural disparities in terms of wage rigidity, the model includes the following elements. First, the exchange rate is irrevocably fixed in a monetary union but in the short-run relative price differences between the two countries are possible. Secondly, the supply side is modeled in such a way as to allow for nominal and real consumption wage rigidity. Thirdly, the model allows for (a)symmetric shocks in goods demand, wages and money demand. Fourthly, two fiscal policy instruments are included, (i) national fiscal stabilisation and (ii) a European

¹ This would call for a three country EMU model. See Eichengreen and Ghironi (1997) for such a three country EMU analysis. Their analysis focuses on strategic interaction between the policy makers under EMU.

Federal Transfer System (EFTS). Finally, in a monetary union there is a common money market which is cleared by the common interest rate. Demand for the common currency is exerted by agents of both EU countries and its supply is controlled by the ECB.

We consider first the supply-side of the economy and the wage formation process. Eqs. (1)-(3) constitute the supply-side of our model.

$$y^s = -\beta(w - p) \quad (1a)$$

$$y^{s*} = -\beta^*(w^* - p^*) \quad (1b)$$

$$w = \mu p^c + u^w \quad (2a)$$

$$w^* = \mu^* p^{c*} + u^{w*} \quad (2b)$$

$$p^c = \gamma p + (1 - \gamma)p^* \quad (3a)$$

$$p^{c*} = \gamma^* p^* + (1 - \gamma^*)p \quad (3b)$$

in which, y^s , denotes aggregate real supply of goods, w , the nominal wage rate, p , the output price level, p^c , the consumer price level and u^w a wage shock that may occur. Foreign variables are marked by an asterisk. Variables are in logs and expressed as deviations from their long-run non-inflationary equilibrium. In the analysis the natural rate of output is normalised to zero². (1) gives aggregate supply of goods in both countries as a increasing function of real wages. Nominal wages in (2) depend on the degree of indexation of wages: if $\mu=0$ nominal consumption wage rigidity prevails whereas in case of $\mu=1$, wages are fully indexed to consumer prices and real consumption wage rigidity prevails. Wages may also change because of exogenous wage shocks. (3) defines the consumer price index as a weighted average of domestic prices and foreign prices weighted by their shares in expenditure γ and $1 - \gamma$.

Next, we consider the aggregate demand side of both economies and here we assume the following structure:

$$y^d = \alpha c - \delta r + \sigma y^* + \eta s + u^d \quad (4a)$$

$$y^{d*} = -\alpha^* c - \delta^* r^* + \sigma^* y + \eta^* s^* + u^{d*} \quad (4b)$$

$$c = p^* - p \quad (5)$$

$$s = f + z \quad (6a)$$

$$s^* = f^* - z \quad (6b)$$

(4) relates aggregate demand, y^d , to competitiveness, c , the real interest rate, r , foreign output, an index of the fiscal stance, s , and an exogenous demand shock, u^d that may hit the economy.

(5) defines competitiveness of country 1 relative to country 2 (remember that the exchange rate is irrevocably fixed). The fiscal stance in (6) is defined as the sum of the fiscal deficit f -

² See Giorno et.al. (1995) on the methodology of estimating potential output, output gaps and structural deficits. European Commission (1995) estimates the NAIRU for the EU countries and divides total unemployment into its cyclical and structural components.

defined as government spending minus taxes-, plus the *net* transfer z received from/given to country 2.

Fiscal policy on the national level is set according to the following countercyclical stabilisation rule:

$$f = -\chi y \quad (7a)$$

$$f^* = -\chi^* y^* \quad (7b)$$

Fiscal policy is aimed at stabilising output fluctuations around equilibrium output which has been normalised to zero as noted earlier. The degree to which it does so depends critically on χ^3 .

The EFTS system is devised such as to alleviate the adjustment burden from asymmetric economic developments. These developments may stem from two sources: country-specific shocks and/or differences in wage setting behaviour. As will be shown in section 3 the latter may give rise to transfers even if the shocks are symmetric. The transfer system automatically transfers resources from countries experiencing a boom to countries that suffer from a recession. One can think of various institutional peculiarities that characterise the set-up of such a transfer system but we decided to include the simplest transfer system that we could think of in our model⁴:

$$z = \xi(y^* - y) \quad (8)$$

If the home country is in a recession, i.e. $y < 0$ and the foreign country is not or to a lesser extent, i.e. $y^* > y$, the EFTS implies an automatic stabilising fiscal transfer from country 2 to country 1 and vice versa. From (8) it is clear that transfers only arise if relative output differences occur. Therefore, the EFTS stabilises in the first place cross-country differences in output fluctuations in the EU, whereas national fiscal policies stabilise national output fluctuations. It is for this reason (see section 3) that the use of the two fiscal policy instruments leads to different output and price adjustments.

Agents of both EMU countries exert demand for the common currency. Money demand is assumed to be a function of the common nominal interest rate, i , output, y , and an exogenous velocity shock, u^m ,

³ See Manasse (1991) for empirical estimates of χ and μ for the period 1973-1984 in the case of Italy, Germany, Japan, U.S., Canada, France and the U.K.

⁴ It is important to distinguish between the stabilising and redistributive dimensions of fiscal transfer systems. Since the transfer system is based on the relative business cycle position of both countries it is essentially a stabilisation device. A redistributive device would redistribute income from countries with a high level of GDP (per capita) to countries with a low level. On the issue of redistribution in the EMU see also various contributions in EC Commission (1993).

$$m - p = \kappa y - \lambda i + u^m \quad (9a)$$

$$m^* - p^* = \kappa^* y^* - \lambda^* i + u^{m^*} \quad (9b)$$

$$i = r + \dot{p} \quad (10a)$$

$$i = r^* + \dot{p}^* \quad (10b)$$

(9) gives the demand for the common currency in both countries whereas (10) defines the nominal interest rate as the real interest minus the rate of producer price inflation. Note that the assumption of a common nominal interest rate implies that inflation differentials must be matched by offsetting changes in the real interest rates. Shocks in our model have only a temporary impact which in case of inflation implies that inflation is zero in the long run. The situation of price level stability therefore means in terms of (10) that real interest rates are equal in the long run. Equilibrium on the common money market implies that the supply of the common currency, \bar{m}^E , that is controlled by the ECB, equals the demand for the common currency by the economic agents of both EMU countries. This equilibrium condition, $\bar{m}^E = m + m^*$, therefore, gives the nominal interest rate that clears the European money market⁵:

$$i = \frac{1}{\lambda + \lambda^*} (\kappa y + \kappa^* y^* + p + p^* + u^m + u^{m^*} - \bar{m}^E) \quad (11)$$

The Phillips curve relates price adjustment to the output gap and implies a short-run trade-off between inflation and output:

$$\dot{p} = v y \quad (12a)$$

$$\dot{p}^* = v^* y^* \quad (12b)$$

Hence, prices adjust sluggishly to shocks (and the resulting output gap) and the model displays Keynesian features in the short-run. In the long run, however, price adjustments will ensure that the actual level of output equals the natural level of output and that inflation is zero.⁶ Depending on the adjustment coefficient v in (12), macroeconomic shocks can generate prolonged and costly output fluctuations in the EU economies (alongside with the costs associated with price adjustments). Sluggish output and price adjustment, therefore, creates a case for designing active macroeconomic stabilisation policies that alleviate business cycle

⁵ Alternatively, we could analyse a setting where the ECB targets the nominal EU interest rate, i . As first shown by Poole (1970), monetary targeting and interest targeting lead to different macroeconomic outcomes if macroeconomic shocks occur. More in line with the intentions of the Bundesbank -and with the expected policies of the ECB-, we assume here that the ECB in the first place uses monetary targeting as guiding principle in its monetary policy. In the simulations in section 3 we assume that monetary policy is not used to stabilise the economies and that the money supply is held fixed.

⁶ In the limiting case of $v \rightarrow \infty$, full adjustment is achieved instantaneously and output remains is always on its natural rate. Some constant could be added to (12) to reflect some positive core inflation rate caused by factors outside the scope of the model.

fluctuations and the divergences in the output cycles of both EMU countries. In the remainder of this paper we will not be concerned with the question whether fiscal policy can have an impact on the level of output (because this is assumed to be the case), but we will instead focus on the question as to how the effectiveness of fiscal policies is affected by the various (a)symmetries in economic shocks and the wage formation.

The model features a number of important channels through which the economies interact with each other:

- (i) by the import leakages, σ and σ^* , output fluctuations in one country are automatically transmitted partially to the other country,
- (ii) if output price adjustment differs in both countries, competitiveness, c , is affected. The fluctuations in competitiveness on their turn affect output adjustment because of the sensitivity -as measured by α and α^* - of aggregate demand to competitiveness.
- (iii) because consumer price inflation is a weighted average of domestic and foreign output price fluctuations, inflation in one country is partially transmitted to higher inflation also in the other country, depending on the weight γ of domestic goods in total consumption.

γ , α and σ -and their foreign counterparts- are model parameters that measure the degree of integration of the two EU economies and have an important role in the transmission of shocks between the two countries. Higher values of these parameters imply that both economies are more integrated and that the various spillovers from foreign policies and foreign macroeconomic shocks increase.

- (iv) monetary conditions in one country transmit themselves immediately to the other country through the adjustment in the common money market. Similarly, monetary policy of the ECB would have a direct impact on both countries because of its transmission through the common money market.
- (v) fiscal stabilisation policies in one country will -because of the various interactions between both countries- also affect output and price adjustment in the other country.
- (vi) the fiscal transfer provides a supra-national stabilisation instrument that reduces divergences in intra-EU divergences in output and price fluctuations.

Model Solution

It is useful to outline the procedure to solve the model. Appendix A provides a detailed derivation. While the model has been kept highly simple, solving the model produces rather complicated expressions because of the various interdependencies between both EMU countries. Combining (1)-(3) enables us to write aggregate supply in both countries. Aggregate demand in both economies is derived from (4)-(8) and (10)-(11). Equilibrium

output in both countries follows when imposing the conditions that the aggregate supply and aggregate demand of domestic goods must be equalized, i.e. $y^s=y^d$ (and that similarly $y^{s*}=y^{d*}$), and that the common nominal interest rate, i , clears the European money market, (11).

Substituting the resulting expression into the Phillips curve (12) gives the dynamics of price adjustment in both economies,

$$\begin{bmatrix} \dot{p} \\ \dot{p}^* \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} p \\ p^* \end{bmatrix} + \begin{bmatrix} u_1 \\ u_2 \end{bmatrix} \quad (15)$$

The definitions of a_{ij} and u_i are given in the Appendix. The different macroeconomic shocks are assumed to hit the economy at $t=0$ and to phase out with a speed ρ^7 . Because nonlinearities in u_1 and u_2 prevent an analytical solution of (15), we rely entirely on numerical simulations of (15) in our analysis of economic shocks and fiscal policy in the next section. Given (15), the fiscal policy stance can be derived: from the price dynamics the adjustment of output follows according to (12), which in turn determines fiscal deficits according to (7) and fiscal transfers according to (8).

The degree of consumer wage indexation is a main determinant of the price and output adjustment following a shock. In case nominal wage rigidity prevails, i.e. if $\mu=0$, prices and output adjust relatively smoothly compared to the case of real wage rigidity, i.e. if $\mu=1$, where adjustment take more time (see (1))⁸. The degree of wage indexation, μ , is thus an important parameter in our model. In the remainder of the analysis we will focus on differences in μ to study a monetary union between countries that display structural disparities.⁹ Indeed, it is often asserted that there are important intra-European differences in labour markets characteristics like wage formation, degree of unionisation, generosity of unemployment benefits and employment protection legislation (OECD (1994), Anderton and Barrell (1991), Heylen and van Poeck (1995) and Bertola and Ichino (1995)).

For our present purposes it suffices to observe that our "proxy" for structural labour market differences, the degree of consumer wage indexation, is found to vary considerably across European countries (see e.g. Layard, Nickell and Jackman (1991), pp. 404-408, Viñals and

⁷ This implies that $u^i = u^i(0) \cdot \exp(-\rho_i t)$ and $u^{i*} = u^{i*}(0) \cdot \exp(-\rho_i^* t)$ where $i = \{d, w, m\}$.

⁸ In his analysis of international cooperation of monetary or fiscal policies, Sheen (1992), also allows for the simultaneous interaction of demand and supply factors. Four regimes are distinguished in his analysis: (i) nominal wage rigidity ($\mu=0$), (ii) real wage rigidity ($\mu=1$), (iii) a 'Keynesian' regime ($\mu=0$ and $\beta \rightarrow \infty$) and (iv) a 'Neo-Classical' regime ($\beta=0$).

⁹ To keep things as simple as possible we assume that a country is characterised by either complete nominal wage rigidity ($\mu=0$) or complete real wage rigidity ($\mu=1$).

Jimeno (1996), pp.13-14 and McMorrow, (1996), section 2.2). Keeping in mind the Lucas critique, one may argue against our idea of differences in μ in the sense that the EMU can lead to a convergence of labour market institutions, and in particular of μ , across the EMU countries (de Grauwe (1994), pp. 32-34). Even if such a convergence would occur it will probably be incomplete and take a considerable amount of time to materialise. Furthermore, monetary policy is just one of the determinants in the wage formation process. It is for these reasons that we assume that differences in the degree of wage indexation persist even after the EMU has been established.

We do not only analyse the impact on output and prices of different types of shocks and the policy reactions, but also we want to assess their impact on social welfare. We assume that social welfare in each country depends on the level of output, the rate of inflation and on the level of the fiscal deficit and the level of transfers:

$$L(t_0) = \int_{t_0}^{\infty} \{y(t)^2 + \psi_1 \dot{p}^c(t)^2 + \psi_2 f(t)^2 + \psi_3 z(t)^2\} e^{-\theta(t-t_0)} dt \quad (16a)$$

$$L^*(t_0) = \int_{t_0}^{\infty} \{y^*(t)^2 + \psi_1^* \dot{p}^{c*}(t)^2 + \psi_2^* f^*(t)^2 + \psi_3^* z(t)^2\} e^{-\theta^*(t-t_0)} dt \quad (16b)$$

in which ψ_1 denotes the weight attached to price stability, ψ_2 the weight that is given to deficit stabilisation, ψ_3 the weight that is given to fiscal transfers and θ the rate of time preference.¹⁰ Fiscal deficits may entail costs because they could imply that sanctions are imposed upon a country according to the ‘Excessive Deficit’ procedure of the EMU Treaty and, in the future, to requirements of the ‘Stability Pact’¹¹. The transfer system may cause welfare losses because of the monitoring, compliance and administrative costs that are associated with its operating. Moreover, it is sometimes argued that fiscal transfers are likely to create ‘moral hazard’ and dependency problems, in particular when they have a sizeable structural component.

3. Simulations with the EMU Model

This section analyses the effects of macroeconomic shocks hitting the two EMU economies under different degrees of structural symmetry between both countries. Both countries may

¹⁰ Note that we do not rule out that both countries differ in their preferences on output and price stability. Alesina and Grilli (1993) show that differences in preferences with respect to price and output stability might further reduce the scope for an efficient monetary union: it is shown that if macroeconomic shocks in a monetary union are more asymmetric and preferences of a country differ more from the EU average that a monetary union for this country becomes less likely to be efficient.

¹¹ A detailed analysis of the setup and workings of the ‘Stability Pact’ is provided by Buti et al. (1997).

vary in the degree to which (i) macroeconomic shocks are (a)symmetric, (ii) wage formation is (a)symmetric. The latter is proxied by (a)symmetric values of the wage indexation parameter μ . To do so, we provide numerical simulations of the two-country EMU model discussed in the previous section. We focus our attention on the effects of transitory, contractionary macroeconomic shocks in the EMU. At the incidence of a negative demand shock, a positive wage shock or a negative velocity shock an instantaneous decline in output is evoked because of a Keynesian multiplier effect. The shock is also transmitted to the other country through the import leakage. The output decline, however, initiates a gradual price adjustment until output is back at its natural level and price level stability is restored.

Our simulation analysis serves two purposes. First, we want to explore the effects of the macroeconomic disturbances in different structural configurations of the EMU. Second, given the effects of the different macroeconomic shocks in the different EMU configurations, we want to study how national and federal fiscal stabilisation can be used to stabilise output and price fluctuations in the EMU.

For the sake of brevity and consistency the simulations focus on a negative demand shock. This is also convenient because a positive wage shock or a negative velocity shock have similar qualitative effects in our model as can be seen in Appendix A. In all simulations we first consider outcomes under a regime with no fiscal flexibility and no federal transfer system, EMU(A), where $\chi=\chi^*=\xi=0$. In this regime, shocks do not provoke any reaction in terms of fiscal policy. It is a useful exercise to compare this benchmark to cases where stabilisation policy is undertaken. The need for fiscal flexibility for individual countries and/or a federal fiscal transfer mechanism may actually increase under a monetary union as countries have given up the possibility to stabilise their individual business cycle fluctuations by means of national monetary policy. This argument in particular holds if there is low wage and price flexibility, low labour mobility and no automatic stabilisation from federal fiscal policies. Therefore, a second regime with fiscal flexibility but no system of transfers EFTS, EMU(B), is studied with $\chi=\chi^*>0$ and $\xi=0$. Finally, a third regime, EMU(C), will be considered in which there is only an EFTS to stabilise the economy: $\chi=\chi^*=0$ and $\xi>0$. The parameter values that underlie all simulations in section 3 are reported in Table 1.

Tabel 1
Modelparameters that Underlie the Simulations

country 1	country 2
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β	1	β^*	1
μ	0/1	μ^*	0/1
γ	0.7	γ^*	0.7
α	0.5	α^*	0.5
δ	0.3	δ^*	0.3
σ	0.5	σ^*	0.5
η	0.7	η^*	0.7
ν	0.15	ν^*	0.15
κ	1	κ^*	1
λ	0.4	λ^*	0.4
χ	0/0.25	χ^*	0/0.25
ξ	0/0.25		
ψ_1	1	ψ_1^*	1
ψ_2	2.5	ψ_2^*	2.5
ψ_3	2.5	ψ_3^*	2.5
ρ	0.15	ρ^*	0.15

The outline of the analysis is as follows: section 3.1 studies symmetric macroeconomic shocks in an EMU that consists of symmetric countries in terms of wage indexation. Section 3.2 studies the effects of symmetric shocks with asymmetric wage indexation, i.e. one country displays nominal wage rigidity whereas the other country is characterized by real wage rigidity. In section 3.3 asymmetric shocks are analysed in a setting with uniform wage formation. Finally, in section 3.4 the case of asymmetric shocks and cross-country differences in wage indexation is analysed.

3.1 *Symmetric Shocks in an EMU with Uniform Wage Formation*

Consider first a negative aggregate demand shock of 1% that hits both EU countries at $t=0$. Figure 1 in Appendix B shows the resulting adjustment pattern of output, prices, fiscal deficits, fiscal transfers and competitiveness. The magnitude of changes in output or prices does of course critically depend on the size of the shock and the values of the various modelparameters as reported in Table 1. The exact numbers are of less interest to us here, because we rather want to focus on qualitative conclusions from the observed adjustment patterns and the differences in the adjustment dynamics between both countries and the different settings we consider.

As a consequence of the shock, output in both countries (panel (a) and (b)) immediately falls and so does inflation as the Phillips curve shifts downward. The drop in output induces a gradual fall in prices (panel (c) and (d)). This deflationary process stimulates output, and output and prices gradually return to their initial equilibrium level. Since the shock is symmetric and the countries are symmetric in terms of the modelparameters, adjustment of all

variables is identical in both countries¹². Consequently, there are no transfers (panel (g)) and outcomes under EMU(A) and EMU(C) coincide. Because of the symmetric adjustment patterns in output and prices, competitiveness (panel (h)) is not affected in any of the regimes and is equal to zero in all periods. At a national level the fiscal deficit (panel (e) and (f)) can be used to counteract the contractionary effect of the adverse macroeconomic shock as is shown for the adjustment process under EMU(B). Output and price variability in that case are less than in case of EMU(A). In the simulation shown in Figure 1 of Appendix B the assumption of nominal wage rigidity is made, if one assumes real wage rigidity in both countries the main difference is that the fall in output is more prolonged and, consequently, the price adjustment process takes more time.

From Figure 1 only an imprecise assessment of the welfare effects of the demand shocks in the different regimes is possible. In order to be more precise, we use (16) to calculate these welfare effects. In doing so we have set $\psi_1=\psi_1^*=1$ and $\psi_2=\psi_2^*=\psi_3=\psi_3^*=2.5$ ¹³. In Table 2 we calculate the welfare losses that result in the different EMU regimes.

Table 2
Welfare under Symmetric Shocks in an EMU with Uniform Wage Formation
($u^d=-0.01$, $u^{d*}=-0.01$, $\mu=0$, $\mu^*=0$)

	country 1	country 2	average	difference
EMU(A)	0.8028	0.8028	0.8028	0
EMU(B)	0.4413	0.4413	0.4413	0
EMU(C)	0.8028	0.8028	0.8028	0

Welfare losses for country 1 and 2 are given in the second and third columns and can be used to calculate the (unweighed) average welfare loss (fourth column) and the difference in

¹² Actually, in a setting with symmetric countries and symmetric macroeconomic shocks, asymmetric adjustment and a case for the EFTS would arise in case the symmetric shocks would have different persistence in both countries. In that case ρ would differ from ρ^* . While not uninteresting, we focus in the remainder of the analysis on the case where symmetric shocks have also symmetric persistence.

¹³ Hence, even though our model displays Keynesian features in the short run, this combination of the weights in the loss function gives relatively high weights to the costs of fiscal policy compared to the benefits of stabilisation.

welfare losses (fifth column). As might be expected, fiscal stabilisation (EMU(B)) reduces welfare losses. With symmetry in structure and macroeconomic shocks, adjustment dynamics in both countries are identical and there is no rationale for the federal transfer system and welfare losses under EMU(C) equal those under EMU(A).

3.2 *Symmetric Shocks in an EMU with Differences in Wage Formation*

Next, and more interestingly, we focus on the effects of symmetric shocks in an EMU where countries differ in their degree of wage indexation. In the literature on EMU almost exclusive emphasis has been given on the case of (a)symmetric shocks and identical countries. We would also like to draw the attention to the possibility that countries with structural differences decide to form a monetary union. Assume, therefore, that both countries are symmetric w.r.t. all structural parameters -as found in Table 1-, except w.r.t. μ , the parameter in (2) that measures to what extent nominal wages are indexed to changes in consumer prices. We assume that country 1 continues to be characterised by nominal wage rigidity, i.e. $\mu=0$, but now country 2 displays real wage rigidity, i.e. $\mu^*=1$ ¹⁴.

The effects of a contractionary demand shock of 1% are displayed in Figure 2. As compared to the case of a uniform wage formation of section 3.1 and Figure 1, output (panel (a) and (b)) and price reactions (panel (c) and (d)) in country 1 are -not very surprisingly- rather similar. The situation in country 2, where $\mu=1$, is more interesting. Even though the *initial* adverse output effect is the same in both countries, price adjustment in country 2 takes more time with the result that compared to the demand shock in section 3.1 in country 2: (i) the negative output gap is more persistent and (ii) deflation is also more persistent in country 2. Both effects help to explain why, notwithstanding the occurrence of a *symmetric* shock, a transfer from country 1 to country 2 develops in EMU(C) (panel (g)). This last result is a strong reminder of the fact that a discussion of stabilisation policies for an EMU in which only shocks may vary across countries can be misleading if countries also differ with respect to structural parameters, i.e. the value of μ .

Since both countries experience a negative demand shock, fiscal deficits are positive in both countries during the adjustment process in EMU(B) (panel (e) and (f)). Note that because country 2 has to cope with a deeper recession, it also has relatively more prolonged budget deficits. Another interesting difference with the example of a symmetric demand shock with a uniform wage formation in section 3.1 is that the demand shock now leads to a change in competitiveness c (panel (h)). Due to the relatively more pronounced deflation in country 2

¹⁴ The reverse is, of course, also feasible and this may turn out to be important in case shocks are asymmetric as well, see section 3.4

competitiveness improves in country 2 which helps to stimulate the demand for goods produced in this country, thereby partly off-setting the contractionary effect of the shock in country 2 (the reverse, of course, holds for country 1).

Table 3 calculates the welfare effects.

Table 3
Welfare under Symmetric Shocks in an EMU with Asymmetric Wage Formation
($u^d = -0.01$, $u^{d*} = -0.01$, $\mu = 0$, $\mu^* = 1$)

	country 1	country 2	average	difference
EMU(A)	0.9170	1.2597	1.0883	-0.3428
EMU(B)	0.4807	0.6733	0.5770	-0.1925
EMU(C)	0.9810	1.1823	1.0817	-0.2013

Once more, for both countries the case of EMU(B) is clearly superior in terms of welfare compared to the "no stabilisation policy" case of EMU(A). While EMU(C) is beneficial for country 2, *average* welfare losses are only marginally smaller than for EMU(A) and considerably higher than under EMU(B). From Figure 2 it can readily be seen that the case of EMU(C), the system of transfers, is welfare inferior compared to the policy of fiscal flexibility on the national level: for both countries the variability of output and inflation is less with EMU(B) than with EMU(C).¹⁵ Hence, symmetric shocks in an EMU with structural differences clearly calls for fiscal flexibility at the national level. It is also interesting to compare the welfare results in Table 3 with the welfare losses in Table 2. Especially country 2 experiences larger welfare losses. Its economy adjusts more sluggishly now after the symmetric shock in EMU. In the case of EMU(C) country 1 is not only forced to transfer funds to country 2, but the resulting welfare loss of the policy of transfers is higher than in case of EMU(A) which thus implies country 1 would be better off if it was decided to conduct no stabilisation policy at all.

3.3 *Asymmetric Shocks in an EMU with Uniform Wage Formation*

In our third example we focus on an EMU that consists of countries that are similar in terms of wage formation (and all other structural parameters), but which are subject to asymmetric

¹⁵ Inspection of (A.2) in Appendix A which gives the aggregate demand equation for both countries reveals that both types of fiscal policy affect the economy in a different way. Whereas both policies directly influence the demand for goods in the home country through their effect on y , the policy of transfers also has an impact through y^* .

shocks. This combination of asymmetric shocks and identical countries has received most attention in the discussion about fiscal policy under EMU. We assume that a negative demand shock of 1% hits country 1 and that there is nominal wage rigidity in both countries. The resulting adjustment process is given in Figure 3. In country 1 output (panel (a)) immediately falls. Through the import leakage, output of country 2 (panel (b)) also is affected. Given the different responses of output, price reactions (panel (c) and (d)) accordingly also differ. Deflation is more pronounced in country 1 which causes a (temporary) improvement in the competitiveness c (panel (h)) of country 1 and this dampens the contractionary effects of the demand shock somewhat in country 1 (at the expense of country 2). In case of EMU(B) where national fiscal flexibility is used as a policy instrument, a similar picture emerges with the deficit reaction being more pronounced in country 1 (panel (e) and (f)).

As can be seen from Table 4, stabilisation policy by means of national fiscal stabilisation is welfare improving for both countries compared with EMU(A).

Table 4
Welfare under Asymmetric Shocks in an EMU with Uniform Wage Formation
($u^d = -0.01$, $u^{d*} = 0$, $\mu = 0$, $\mu^* = 0$)

	country 1	country 2	average	difference
EMU(A)	0.4903	0.0467	0.2687	0.4434
EMU(B)	0.3010	0.0136	0.1618	0.2963
EMU(C)	0.3902	0.1152	0.2527	0.2750

Since the shock is asymmetric, the case of EMU(C) where federal fiscal stabilisation is conducted by means of (8) is relevant. The relatively strong recession in country 1 leads to a transfer from country 2 to country 1 (panel g). Although compared to EMU(A) stabilisation by means of the EFTS is good news for country 1 in terms of welfare, this is not the case for country 2¹⁶. For the latter the transfer depresses output to the extent that it would be better off without a stabilisation policy at all. On average a federal stabilisation system is welfare superior compared with the "no policy" regime of EMU(A). At any rate, fiscal flexibility outperforms the EFTS. Hence, the idea that a system of automatic transfers might be a good way of dealing with (a)symmetric shocks is, at least in our Mundell-Fleming model of the EMU, subject to some important qualifications. It is certainly not superior compared with

¹⁶ Our analysis focuses on the effects of one unique macroeconomic shock. In a full stochastic analysis with shocks hitting country 1 and country 2 randomly, the case for an EFTS would increase further as it provides both countries -not only country 1 as in our example- a certain degree insurance against the adverse effects of asymmetric shocks.

automatic stabilisation on the national level. This point is also made by Eichengreen (1996).¹⁷

3.4 *Asymmetric Shocks in an EMU with Differences in Wage Formation*

A fourth example arises if not only macroeconomic shocks are asymmetric but also the degree of wage indexation differs between the two countries. To grasp the relevance of allowing for differences in μ in this example, it is insightful to compare the simulation results in Figure 4a and 4b with the case of asymmetric shocks and a uniform wage formation shown in Figure 3. Two cases need to be distinguished. In the first one, the shock hits country 1 in a setting where country 1 displays nominal wage rigidity and country 2 real wage rigidity. In the second case, the shock still hits country 1 but now country 1 displays real wage rigidity and country 2 nominal wage rigidity.

The simulation results of the first case are shown in Figure 4a. The asymmetric negative demand shock of 1% in country 1 leads to an instantaneous fall in output of country 1 (panel (a)) and the by now well-known subsequent price adjustments (panel (c)). Output also starts to contract in country 2 (panel (b)). As can be seen from comparing Figure 3 with Figure 4a the effects of the demand shocks for country 1 are very similar. The same conclusion holds for the reactions in terms of fiscal flexibility f (panel (e)), the transfers z (panel (g)) and competitiveness c (panel (h)). Therefore, welfare losses in country 1 as calculated in the first part of Table 5 below are not much different from those in Table 3.

Things are, however, somewhat different for country 2 where, due to the existence of real wage rigidity, it does take more time to establish price stability and to close the output gap. This also has interesting policy implications which can be detected by comparing Figure 3 with Figure 4a. Given that the output and price effects of the demand shock are more prolonged in country 2, the fiscal deficits in the EMU(B) scenario have to be sustained for a number of additional periods (panel f). In the EMU(C) scenario, the transfers, it is still true that funds are transferred from country 2 to country 1 but the amount of transfers is smaller reflecting the relative better performance of country 2 in the asymmetric shock example with a uniform wage formation. According to Table 5, welfare losses in country 2 are slightly higher in all EMU cases than in section 3.3 when country 2 featured nominal wage rigidity and more adjustment capability. All in all, the differences between Figure 4a and Figure 3 and the corresponding welfare losses in Table 4 and the first part of Table 5 are not very substantial.

¹⁷ The fact that *ceteris paribus* (compare f.i. Table 2 with Table 4) the difference in average welfare loss between EMU(B) and (EMU(C) is larger for symmetric shocks as compared to asymmetric shocks is not surprising since in case of symmetric shocks EMU(B) implies that *both* countries are engaged in stabilising the economy.

Table 5
Welfare under Asymmetric Shocks in an EMU with Asymmetric Wage Formation
($u^d=-0.01$, $u^{d*}=0$, (a) $\mu=0$, $\mu^*=1$, (b) $\mu=1$, $\mu^*=0$)

	country 1	country 2	average	difference
(a)				
EMU(A)	0.5258	0.0763	0.3011	0.4494
EMU(B)	0.3224	0.0261	0.1742	0.2962
EMU(C)	0.4352	0.1470	0.2910	0.2884
(b)				
EMU(A)	0.7270	0.0598	0.3934	0.6672
EMU(B)	0.4360	0.0171	0.2265	0.4189
EMU(C)	0.5704	0.1556	0.3631	0.4146

This last conclusion needs to be qualified (at least in a quantitative sense) in the second case where an asymmetric demand shock hits country 1, which now features real wage rigidity, whereas country 2 features nominal wage rigidity, implying that $\mu=1$ and $\mu^*=0$. The adjustment in this EMU setting is given in Figure 4b. As might be expected, if in the country where the shock takes place, real instead of nominal consumption wage rigidity prevails, the main effect is that output and price adjustments take more time (panels (a) and (c)). Also for country 2 the price adjustment changes: nominal instead of real wage rigidity in country 2 implies that the transmission of the demand shock from country 1 has more modest effects on output and prices (compare Figures 4a and 4b panels (b) and (d)). Again, the reason for this is that a relatively speedier adjustment takes place if nominal instead of real wages are sticky. Transfers z to the country where the demand shock takes place are higher in the second example (panel (g)). Another subtle difference between Figures 4a and 4b is that the change in real competitiveness c is more pronounced in Figure 4b because there is hardly any deflation in country 2, implying a greater improvement in c for the country 1 that is hit by the contractionary demand shock (panel (h)).

The welfare effects of the second case are given in the second part of Table 5. If one compares the welfare results with the first case (asymmetric shock, $\mu=0$ in country 1 and $\mu^*=1$ in country 2) and Table 4 (asymmetric shock, $\mu=0$ in both countries) it becomes clear that the welfare loss for country 1, the country invariably hit by the shock, are about 30% larger in case this country is characterized by real instead of nominal wage rigidity. In country 2 transfers are still an inefficient policy instrument: the welfare loss stays about the same following the switch of country 2 from real to nominal wage rigidity whereas the welfare losses for EMU(A) and EMU(B) dwindle.

For the EMU as a whole the larger welfare losses for country 1 are somewhat mitigated by

the smaller welfare losses in country 2 but the *average* welfare loss is nonetheless also greater in the case shown in Figure 4b. Despite the differences between Figures 2, 4a and 4b, it remains true that (irrespective of the assumptions regarding the degree of wage indexation) the preferred regime ranking for the EMU as a whole in case of an asymmetric shock is $B > C > A$.¹⁸

If one compares Figure 3 (asymmetric demand shock with uniform wage formation) with Figure 4 and 4b (asymmetric demand shock with differences in wage indexation) the first conclusion must be that -as opposed to the case of a symmetric shock- the introduction of a different degree of wage indexation does not lead to qualitatively different simulation results. But this does not mean that there are no relevant (quantitative) differences in terms of welfare as can be seen from Tables 3 and 5. It also matters a great deal for the effectiveness of the national and federal fiscal policy instruments whether a country is characterised by nominal or real consumption wage rigidity. The second conclusion is that country 1, the country hit by the adverse demand shock, is better off if country 2 is characterized by nominal instead of real consumption wage rigidity (compare the second column in the upper and lower half of Table 5). This illustrates a more general point. If a country is hit by a macroeconomic shock, it will be better off -irrespective of its own degree of wage indexation- if it forms a monetary union with a country characterised by nominal wage rigidity. The reason for this is that nominal wage rigidity in the foreign country implies that output and prices return quicker to their long-run equilibrium levels than if real wage rigidity prevails, thereby increasing imports from the home country (both because of higher output and deteriorating competitiveness of the foreign economy) and inducing higher transfers towards the home country.

4. Fiscal Stabilisation, Economic Integration and Welfare under EMU

The preceding analysis showed that it is important in the context of EMU not only to distinguish between symmetric and asymmetric shocks but also to consider the degree of structural (a)symmetry between the EMU countries. Our attention in particular focused on the wage formation process of the EMU countries. We varied the degree of symmetry of macroeconomic shocks, wage indexation and national and federal fiscal flexibility and showed how these variables affect macroeconomic outcomes and welfare losses in EMU. The observed dynamic adjustment patterns are -even in our stylized model- the result of the complex interaction of output and price dynamics, the fiscal policies and the interaction with the other EMU country. From a policy perspective we focused on the usefulness of fiscal stabilisation both by national fiscal policies and federal fiscal policies. In all settings, we

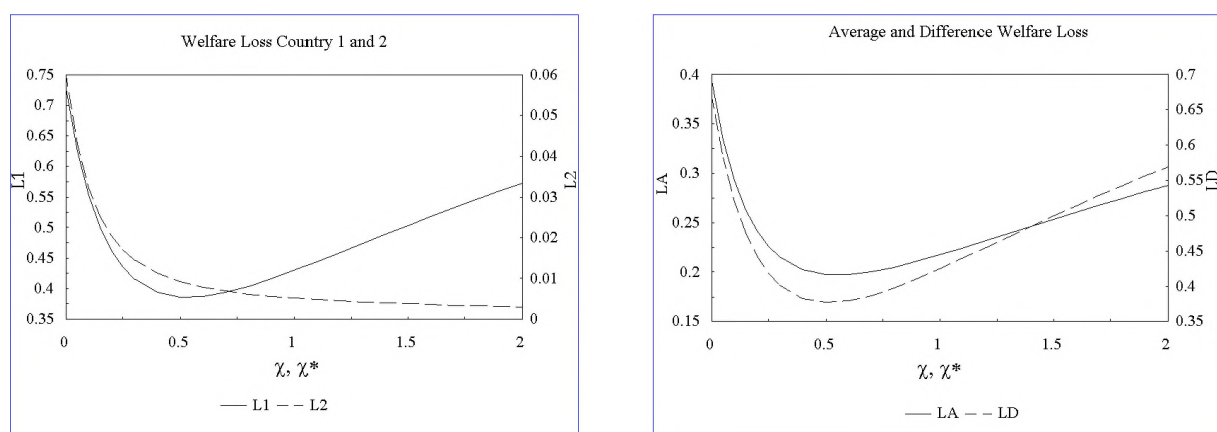
¹⁸ For country 2 the ranking in case of an asymmetric shock is, however, $B > A > C$.

found that fiscal flexibility at the national level may be conducive to stabilise macroeconomic fluctuations under EMU. In addition, in a number of cases also federal fiscal flexibility was shown to be relevant and useful. Our analysis suggests that elimination of fiscal flexibility under EMU deteriorates the adjustment capacity of the economies and therefore would result in suboptimal economic performance.

Welfare losses according to (16) are the direct result of these complex adjustment dynamics of output, prices and policies and the interaction and interdependency with the other EMU country, as indicated on p.7¹⁹. In this section we explore in a bit more detail the relations between fiscal stabilisation, economic integration and welfare in our EMU model. First, we analyse how welfare varies with changes in the parameters χ and ξ , that measure the responsiveness of the 2 fiscal policies to deviations of output from its natural level. Second, we investigate how welfare varies if the degree of economic integration is changed. Here, we focus on changes in the responsiveness of net exports w.r.t. competitiveness, as measured by α .

Our interest in χ and ξ results from the possibility to choose values of χ and ξ which minimise the welfare loss *given* the nature of the shock and the structure of the economy. In other words, we would want to analyse welfare losses as a function of χ or ξ . Figure 5 shows the welfare losses as a function of χ .

Figure 5
Welfare Losses as a Function of χ ($=\chi^*$)



¹⁹ In addition, the rate of time preference and the weights in the loss functions have an effect on the exact welfare losses that result in the different settings that are considered.

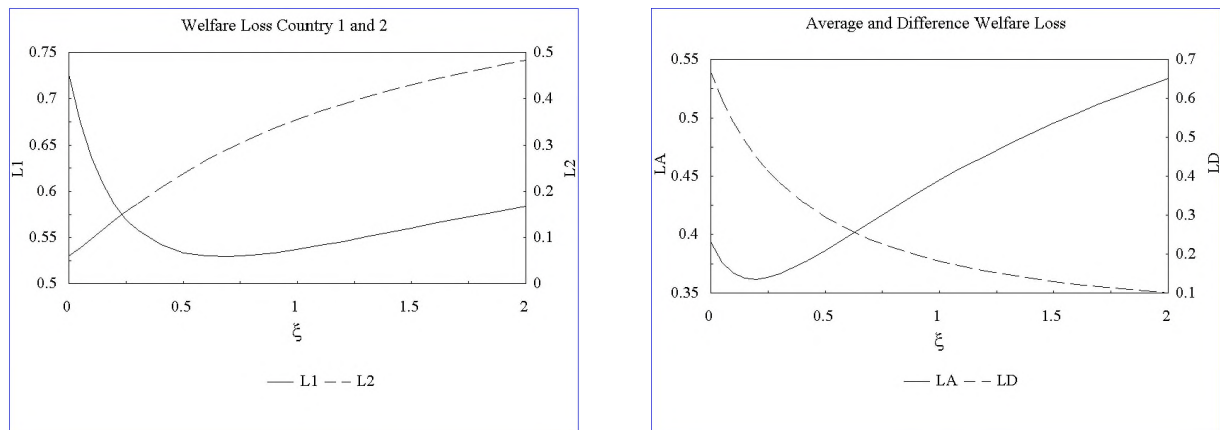
Apart from χ all other parameter values remain unchanged (see Table 1) and, for the sake of brevity, we focus on the case shown in Figure 4b of an asymmetric demand shock in country 1 and where country 1 displays real wage rigidity and country 2 nominal wage rigidity.²⁰ Figure 5 shows the welfare losses as a function of χ and χ^* and it therewith illustrates the welfare effects under the EMU(B) regime for $0 < \chi = \chi^* < 2$.²¹ The left panel of Figure 5 shows the welfare losses for both countries. For country 1 there is clearly a trade-off between stabilising output and prices on the one hand and the welfare costs associated with fiscal deficits on the other hand (see (16)). The welfare loss is minimized for $\chi \approx 0.5$ in this specific example and for values of $\chi > 0.5$ the costs of fiscal flexibility thus start to outweigh the benefits. For country 2 there is no such trade off, the relatively small fiscal deficit (remember country 1 is "shocked" and country 2, with $\mu^* = 0$, also has a smoother price adjustment process) implies that the welfare costs of fiscal stabilisation are low and that this country would opt for a (infinitely) large value of χ^* . The right panel of Figure 5 gives the average welfare loss and intra-country difference welfare loss as function of the two fiscal flexibility parameters. Both curves tell more or less the same story: fiscal stabilisation is welfare enhancing (if $\chi = \chi^* = 0$ the EMU(A) regime results), but only up to a certain value of χ . Beyond this value the costs associated with fiscal deficits, f.i. in terms of the 'Stability Pact', are greater than the stabilisation benefits.

Next, we consider the same case of an asymmetric demand shock in country 1 and where country 1 displays real wage rigidity and country 2 nominal wage rigidity, but where we vary the amount of fiscal flexibility in federal fiscal policies. Figure 6 shows the welfare losses as a function of ξ .

Figure 6
Welfare Losses as a Function of ξ

²⁰ In section 3 both fiscal policy parameters were either 0 or 0.25 depending on the EMU regime under consideration. Simulations like the ones shown in Figures 5-7 can, of course, also be derived for the other examples discussed in section 3.

²¹ In Figure 5 we have assumed that $\xi = 0$ and in Figure 6 that $\chi = \chi^* = 0$.

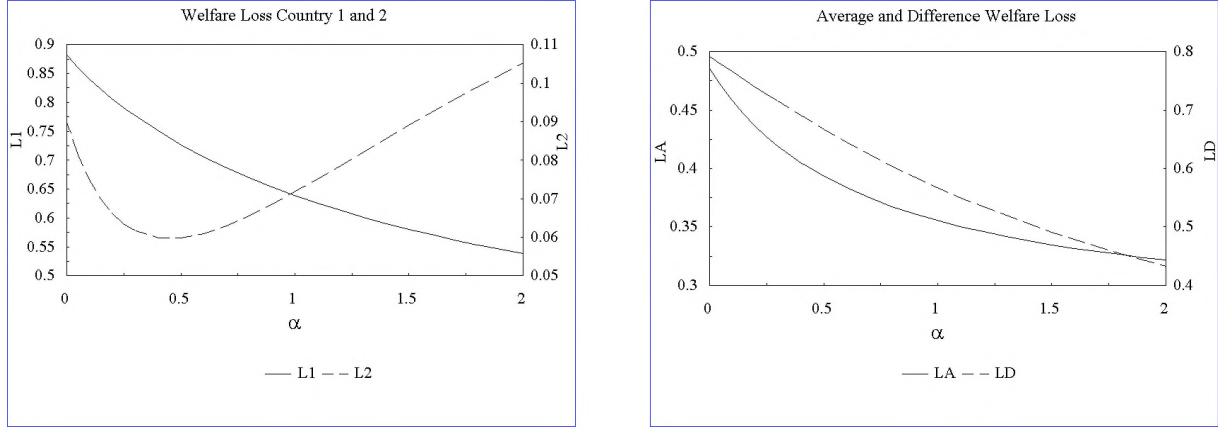


Now there is no fiscal flexibility at the national level, i.e. $\chi = \chi^* = 0$. The left panel of Figure 6 leads for country 1 again to the conclusion that there is an optimum value for the transfer parameter ($\xi_{\text{opt}} \approx 0.7$ in this specific example). Assuming that a transfer system involves administrative and monitoring costs a policy of fiscal transfers does thus not lead to an optimum value $\xi_{\text{opt}} \rightarrow \infty$ for the country receiving the transfers. Things are different for country 2. We saw already in section 3.4 that for this country "doing nothing" is welfare superior to a policy of transfers which means that the optimum level of ξ is 0. On average -see the right panel of Figure 6- a system of transfers is, however, better than the no stabilisation regime of EMU(A) where $\xi = 0$. This is due to the fact (see also the welfare loss difference in Figure 6) that up to a certain value of ξ , the positive net benefits of the transfer system for country 1 clearly outweigh the negative net benefits for country 2. In this sense Figure 6 indicates that a transfer system can reduce intra-EU welfare differences in such away that it leads to a higher level of welfare for the monetary union as a whole.²²

Finally, we analyse how changes in α -which depicts the responsiveness of aggregate demand w.r.t. competitiveness- affect welfare losses. Simulations with respect to variations in α are interesting because the extent to which shocks and fiscal policies are transmitted, does depend crucially on the degree of economic integration. As stated in the introduction of this section, we are interested in the welfare effects of changes in the degree of economic integration between the two countries because the strength of the various transmission channels determines to what extent a country is affected by the economic developments in the other country. In line with the analysis of $L(\chi)$ and $L(\xi)$, one can conceive welfare to be a function of the parameters measuring the degree of economic integration. Figure 7 shows the welfare losses as a function of α .

²² Note however, in line with the simulation results in section 3, that the minimum value of $L(\chi)$ is lower than that for $L(\xi)$.

Figure 7
Welfare Losses as a Function of α



The left panel of Figure 7 shows for both countries welfare as a function of α (see (4)).²³ An increase in this parameter means improved competitiveness for country 1 and hence an increased demand for the goods produced by country 1 (the reverse, of course, is true for country 2). Figure 7 indicates that country 1, following its improved competitiveness due to a relatively strong deflation, would prefer α to be infinitely large to the extent that the negative consequences of the demand shock are off-set by the increase in demand due to the resulting rise in competitiveness c . For country 2 the optimum value of α is not (as one might perhaps expect) 0 but about 0.45. Country 2 is initially not affected by the shock, but output and prices fall nevertheless somewhat due to the various channels transmitting the shock. In this sense country 2 would welcome a swift return of output and prices in country 1 to their long-run equilibrium levels. Given the relatively slow price adjustment process in country 1 ($\mu=1$), an increase in competitiveness *inter alia* helps to bring about such a return. It is therefore possible that for a certain range of parameter values the benefits of an increase in α outweigh the costs in terms of a fall of competitiveness. But if α increases further the loss of competitiveness starts to dominate the welfare outcome. On average, see the right panel of Figure 7, the monetary union benefits if α increases.

5. Conclusions

²³ As with Figure 5 and 6, Figure 7 is also based on the case of an asymmetric demand shock hitting country 1 given real wage rigidity in country 1 and nominal wage rigidity in country 2. Apart from α all parameter values are the same as those reported in Table 1.

In this paper we have used a variant of a two country Mundell-Fleming model to analyse the effects of fiscal stabilisation in a monetary union. Economic shocks can be symmetric or asymmetric in the model and, most importantly, the economic developments between the two countries can also vary because of a different degree of wage indexation.

By means of simulations we showed how the impact of economic shocks on macro-economic performance as well as the effectiveness of fiscal policy may depend heavily on the assumed wage formation process. In the literature on the role of fiscal policy in the EMU, countries are invariably assumed to be the same as far as the underlying models of the economies concerned. Cross-country differences in macroeconomic adjustment must then be the result of asymmetric shocks. In our view this approach neglects the importance of structural differences between European countries. We used simulations with our model to show that, compared to the case where the economic structure of countries is assumed to be the same, a negative demand shock can lead to substantial differences in macro-economic performance and policy effectiveness if countries are allowed to differ with respect to wage indexation. The calculation of the social welfare effects supports our simulation results. A sensitivity analysis of the welfare effects with respect to parameters measuring the degree of fiscal stabilisation and economic integration indicated that for a range of these parameter values fiscal stabilisation is welfare enhancing for the union as a whole despite the fact that fiscal stabilisation also entails costs. A fruitful line for further research would be to analyse (on a more detailed level) additional structural disparities between EMU-members and their implications for stabilisation policies in- and outside EMU.

Appendix A System Dynamics

As mentioned in the main text, our basic model of (1)-(11) can be reduced to a dynamic system in the producer price levels of both countries and which from the complete dynamic adjustment of the model follows. Combining (1)-(3) enables to write the aggregate supply of goods by the domestic and foreign economies

$$y^s = \beta(1-\mu\gamma)p - \beta\mu(1-\gamma)p^* - \beta u^w \quad (\text{A.1a})$$

$$y^{s*} = \beta^*(1-\mu^*\gamma^*)p^* - \beta^*\mu^*(1-\gamma^*)p - \beta^* u^{w*} \quad (\text{A.1b})$$

The aggregate demand for the output in both economies is found from (4)-(8), (10)-(11):

$$d = \left(-\alpha - \frac{\delta(\gamma+1-\gamma^*)}{\lambda+\lambda^*}\right)p + \left(\alpha - \frac{\delta(\gamma^*+1-\gamma)}{\lambda+\lambda^*}\right)p^* - (\eta(\chi+\xi) + \frac{\delta\kappa}{\lambda+\lambda^*}) \\ + \left(\sigma + \eta\xi - \frac{\delta\kappa^*}{\lambda+\lambda^*}\right)y^* + \delta\gamma\dot{p} + \delta(1-\gamma)\dot{p}^* - \frac{\delta}{\lambda+\lambda^*}(u^m + u^{m*}) + u^d \quad (\text{A.2a})$$

$$\left(-\alpha^* - \frac{\delta^*(\gamma^*+1-\gamma)}{\lambda+\lambda^*}\right)p^* + \left(\alpha^* - \frac{\delta^*(\gamma+1-\gamma^*)}{\lambda+\lambda^*}\right)p - (\eta^*(\chi^*+\xi) + \frac{\delta^*\kappa}{\lambda+\lambda^*}) \\ (\sigma^* + \eta^*\xi - \frac{\delta^*\kappa^*}{\lambda+\lambda^*})y + \delta^*\gamma^*\dot{p}^* + \delta^*(1-\gamma^*)\dot{p} - \frac{\delta^*}{\lambda+\lambda^*}(u^m + u^{m*}) + u \quad (\text{A.2b})$$

Ex-post, the aggregate supply of output in a country must equal the aggregate demand for its output. Therefore we find output in country 1 when equating (A.2a) and (A.2b) and output in country 2 when equating (A.1b) and (A.2b) imposing that the common nominal interest rate, i , clears the European money market, implying that money demand equals the money supply set by the ECB, i.e. $m+m^*=\bar{m}^E$. Substituting the resulting expression into the Phillips curve (7) gives the dynamics of price adjustment in both economies:

$$\begin{bmatrix} \dot{p} \\ \dot{p}^* \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} p \\ p^* \end{bmatrix} + \begin{bmatrix} u_1 \\ u_2 \end{bmatrix} \quad (\text{A.3})$$

in which a_{ij} equals:

$$\Delta_2 + \frac{\Delta_4\Delta_3^*}{\Delta_1^*} + \frac{\Delta_4\delta^*v^*\Delta_1(\Delta_3^* + \frac{\Delta_4\Delta_2^*}{\Delta_1^*})}{\Delta_1^*(\Delta_1\Delta_1^* - \Delta_4\Delta_4^* - v^*\Delta_1\delta^*)} \quad a_{12} = h_1(\Delta_3 + \frac{\Delta_4\Delta_2^*}{\Delta_1^*} + \frac{\Delta_4\delta^*v^*\Delta_1(\Delta_2^* + \frac{\Delta_4\Delta_1^*}{\Delta_1^*})}{\Delta_1^*(\Delta_1\Delta_1^* - \Delta_4\Delta_4^* - v^*\Delta_1\delta^*)}) \quad (\text{A.4a})$$

$$\Delta_3 + \frac{\Delta_4\Delta_2^*}{\Delta_1^*} + \frac{\Delta_4\delta v\Delta_1^*(\Delta_2 + \frac{\Delta_4\Delta_3^*}{\Delta_1^*})}{\Delta_1(\Delta_1\Delta_1^* - \Delta_4\Delta_4^* - v\Delta_1\delta^*)} \quad a_{22} = h_2(\Delta_2 + \frac{\Delta_4\Delta_3^*}{\Delta_1^*} + \frac{\Delta_4\delta v\Delta_1^*(\Delta_3 + \frac{\Delta_4\Delta_1^*}{\Delta_1^*})}{\Delta_1(\Delta_1\Delta_1^* - \Delta_4\Delta_4^* - v\Delta_1\delta^*)}) \quad (\text{A.4b})$$

Δ_i equals,

$$\begin{aligned}
\Delta_1 &= \frac{\delta \kappa}{\lambda + \lambda^*} + \eta(\chi + \xi) & \Delta_1^* &= \frac{\delta^* \kappa^*}{\lambda + \lambda^*} + \eta^*(\chi^* + \xi) \\
\Delta_2 &= -\alpha - \frac{\delta(\gamma + 1 - \gamma^*)}{\lambda + \lambda^*} - \beta(1 - \mu\gamma) & \Delta_2^* &= -\alpha^* - \frac{\delta^*(\gamma^* + 1 - \gamma^*)}{\lambda + \lambda^*} - \beta^*(1 - \mu^*\gamma^*) \\
\Delta_3 &= \alpha - \frac{\delta(\gamma^* + 1 - \gamma)}{\lambda + \lambda^*} + \beta\mu(1 - \gamma) & \Delta_3^* &= \alpha^* - \frac{\delta^*(\gamma + 1 - \gamma^*)}{\lambda + \lambda^*} + \beta^*\mu^*(1 - \gamma^*) \\
\Delta_4 &= \sigma + \eta\xi - \frac{\delta \kappa^*}{\lambda + \lambda^*} & \Delta_4^* &= \sigma^* + \eta^*\xi - \frac{\delta^* \kappa}{\lambda + \lambda^*}
\end{aligned} \tag{A.5}$$

h_{μ} ,

$$h_1 = \frac{v\Delta_1^*(\Delta_1\Delta_1^* - \Delta_4\Delta_4^* - v^*\Delta_1\delta^*)}{(\Delta_1\Delta_1^* - \Delta_4\Delta_4^* - v\Delta_1^*\delta)(\Delta_1\Delta_1^* - \Delta_4\Delta_4^* - v^*\Delta_1\delta^*) - v\Delta_4\delta^*v^*\Delta_4^*\delta} \tag{A.6a}$$

$$h_2 = \frac{v^*\Delta_1(\Delta_1\Delta_1^* - \Delta_4\Delta_4^* - v\Delta_1^*\delta)}{(\Delta_1\Delta_1^* - \Delta_4\Delta_4^* - v\Delta_1^*\delta)(\Delta_1\Delta_1^* - \Delta_4\Delta_4^* - v^*\Delta_1\delta^*) - v\Delta_4\delta^*v^*\Delta_4^*\delta} \tag{A.6b}$$

and u_p

$$\begin{aligned}
u_1 &= h_1 \left(\left(1 + \frac{\Delta_4\delta^*v^*\Delta_4^*}{\Delta_1^*(\Delta_1\Delta_1^* - \Delta_4\Delta_4^* - v^*\Delta_1\delta^*)} \right) (u^d + \beta u^w - \frac{\delta}{\lambda + \lambda^*} (u^m + u^{m*} - \bar{m}^E)) \right. \\
&\quad \left. + \left(\frac{\Delta_4}{\Delta_1^*} + \frac{\Delta_4\delta^*v^*\Delta_1}{\Delta_1^*(\Delta_1\Delta_1^* - \Delta_4\Delta_4^* - v^*\Delta_1\delta^*)} \right) (u^{d*} + \beta^* u^{w*} - \frac{\delta^*}{\lambda + \lambda^*} (u^m + u^{m*} - \bar{m}^E)) \right)
\end{aligned} \tag{A.7a}$$

$$\begin{aligned}
u_2 &= h_2 \left(\left(\frac{\Delta_4^*}{\Delta_1} + \frac{\Delta_4^*\delta v\Delta_1^*}{\Delta_1(\Delta_1\Delta_1^* - \Delta_4\Delta_4^* - v\Delta_1^*\delta)} \right) (u^d + \beta u^w - \frac{\delta}{\lambda + \lambda^*} (u^m + u^{m*} - \bar{m}^E)) \right. \\
&\quad \left. + \left(1 + \frac{\Delta_4^*\delta v\Delta_4}{\Delta_1(\Delta_1\Delta_1^* - \Delta_4\Delta_4^* - v\Delta_1^*\delta)} \right) (u^{d*} + \beta^* u^{w*} - \frac{\delta^*}{\lambda + \lambda^*} (u^m + u^{m*} - \bar{m}^E)) \right)
\end{aligned} \tag{A.7b}$$

All macroeconomic shocks take the form of impulses that hit the economies at $t=0$ and decay at a speed ρ , implying $u^d = u^d(0).e^{-\rho t}$, $u^{d*} = u^{d*}(0).e^{-\rho t}$, $u^w = u^w(0).e^{-\rho t}$, $u^{w*} = u^{w*}(0).e^{-\rho t}$, $u^m = u^m(0).e^{-\rho t}$ and $u^{m*} = u^{m*}(0).e^{-\rho t}$.

Appendix B Graphs of the Simulations

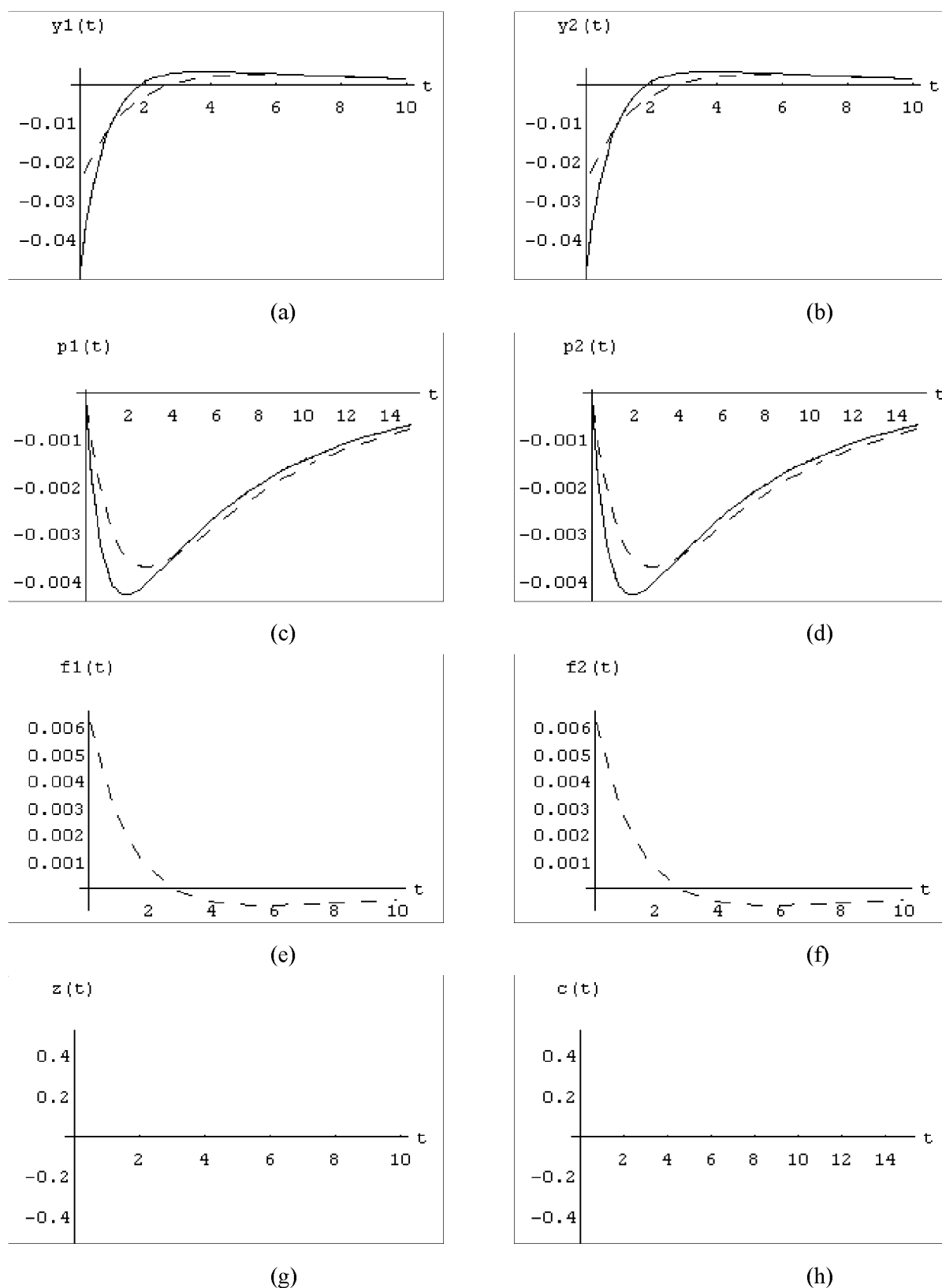


Figure 1

Symmetric Demand Shock, Symmetric Countries ($u^d = -0.01$, $u^{d*} = -0.01$, $\mu = 0$, $\mu^* = 0$)

— EMU(A) - - - EMU(B) EMU(C)

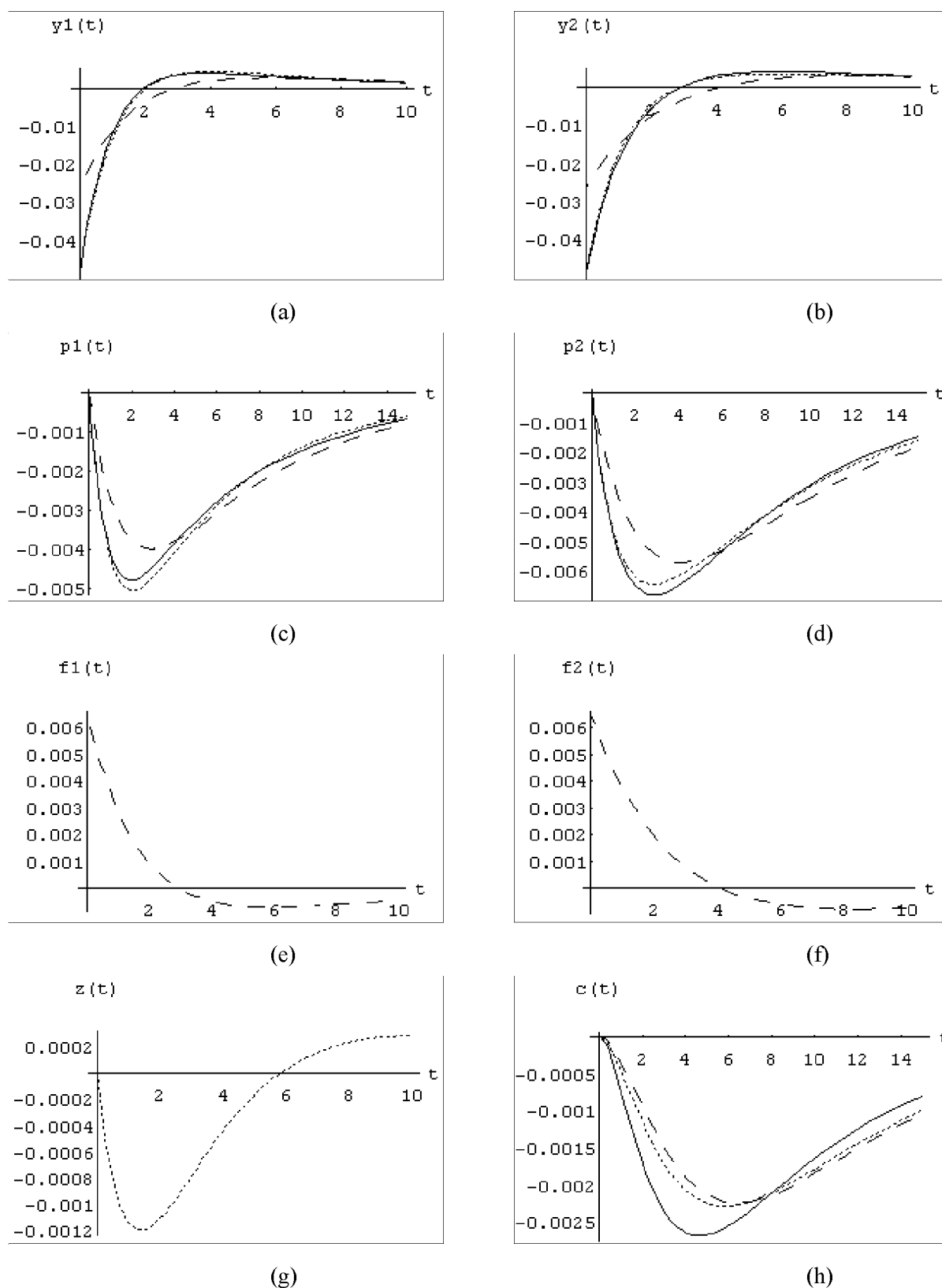


Figure 2
Symmetric Demand Shock, Asymmetric Countries ($u^d = -0.01$, $u^{d*} = -0.01$, $\mu = 0$, $\mu^* = 1$)
_____ EMU(A) ---- EMU(B) EMU(C)

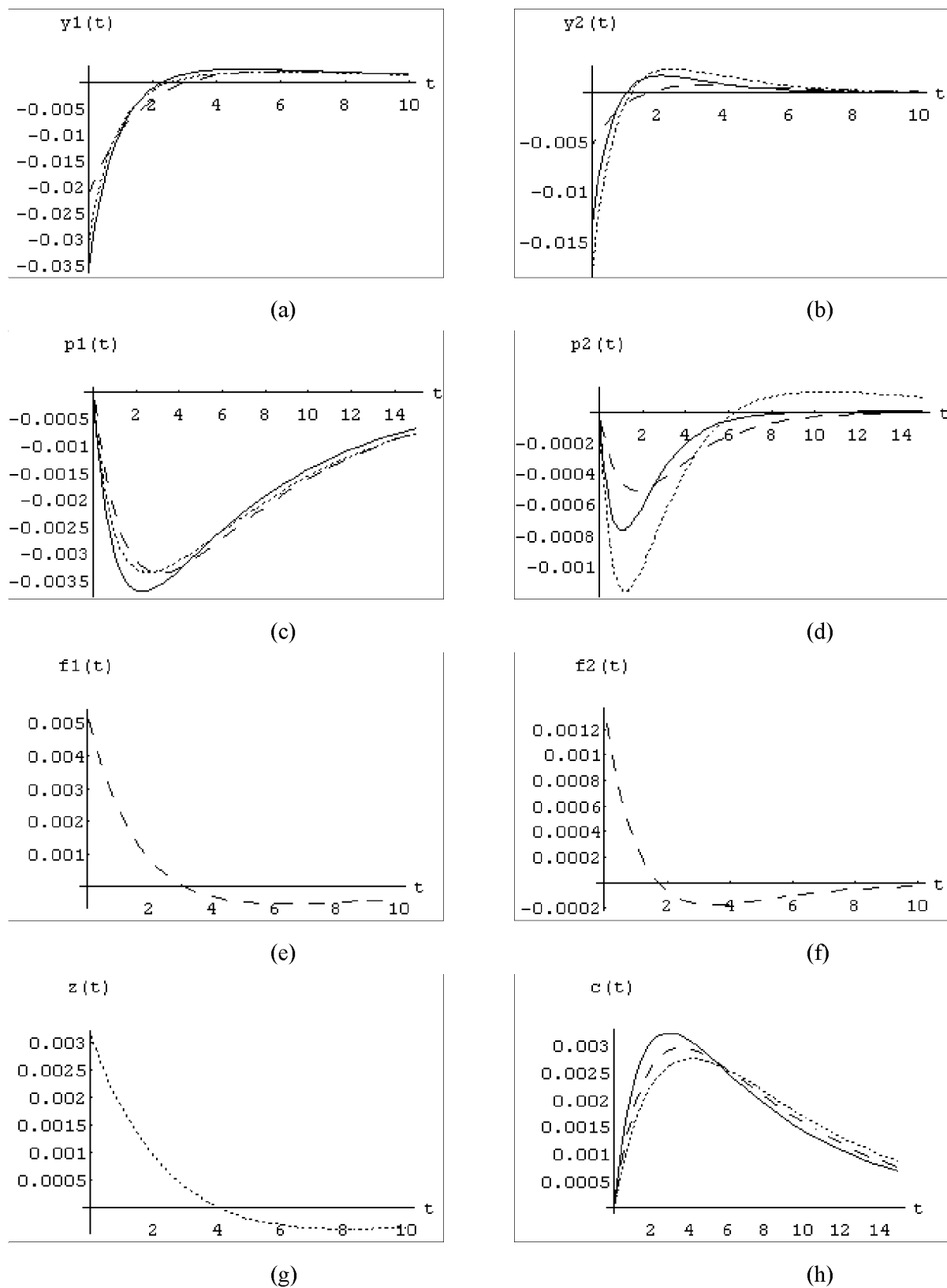


Figure 3
 Asymmetric Demand Shock, Symmetric Countries ($u^d = -0.01, u^{d*} = 0, \mu = 0, \mu^* = 0$)
 — EMU(A) - - - EMU(B) EMU(C)

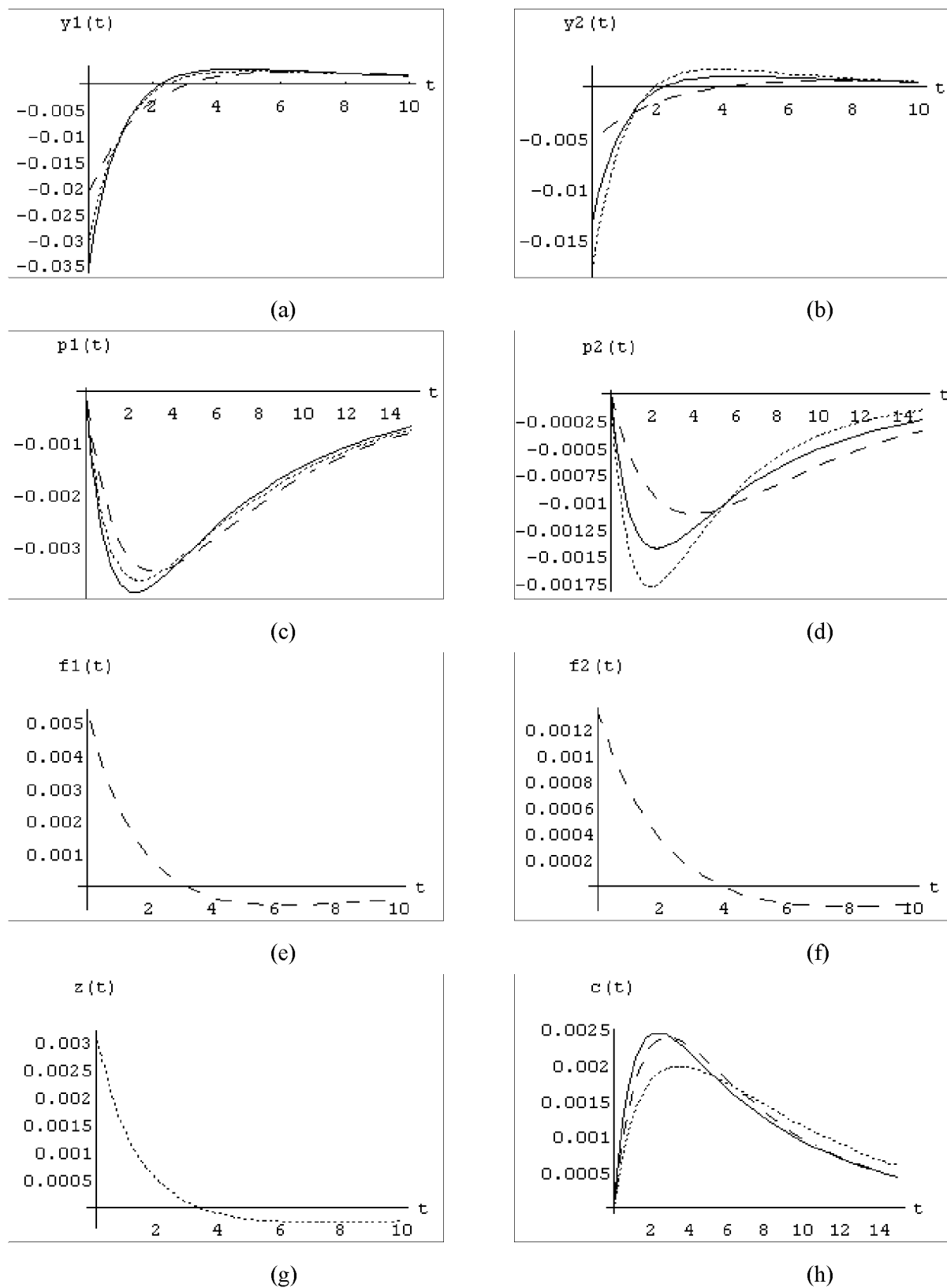


Figure 4a

Asymmetric Demand Shock, Asymmetric Countries ($u^d = -0.01$, $u^{d*} = 0$, $\mu = 0$, $\mu^* = 1$)

— EMU(A) --- EMU(B) EMU(C)

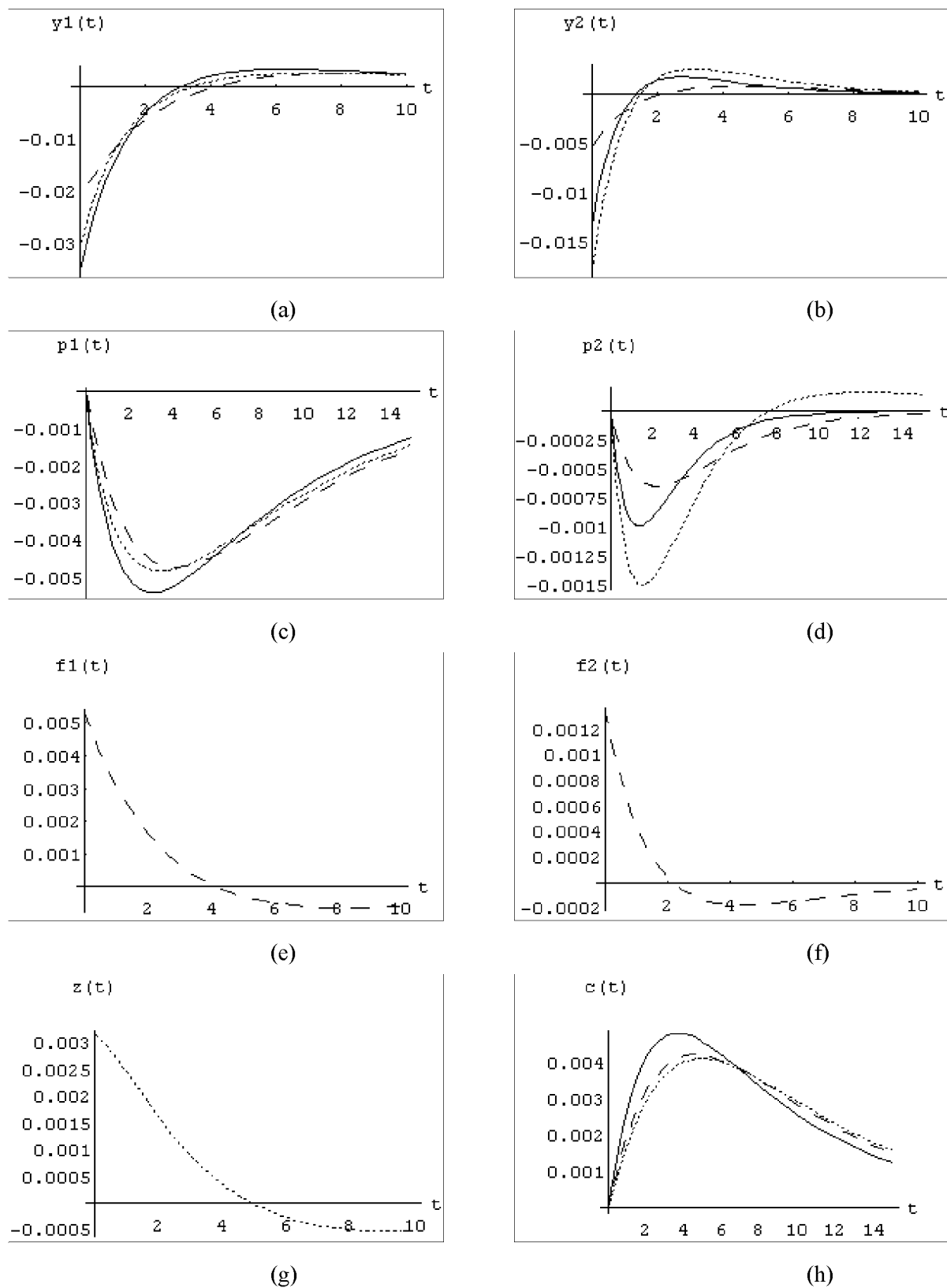


Figure 4b
Asymmetric Demand Shock, Asymmetric Countries ($u^d = -0.01$, $u^{d*} = 0$, $\mu = 1$, $\mu^* = 0$)
— EMU(A) --- EMU(B) EMU(C)

References

- Abraham, F. (1996), "Regional Adjustment and Wage Flexibility in the European Union", *Regional Science and Urban Economics*, **26**, 51-75
- Alesina, A. and V. Grilli (1993), "On the Feasibility of a One-Speed or Multispeed European Monetary Union", *Economics and Politics*, **5**, 145-165
- Anderton, A. and R. Barrell (1995), "The ERM and Structural Change in European Labour Markets: a Study of 10 Countries", *Weltwirtschaftliches Archiv*, **131**, 47-66
- Bayoumi, T. and B. Eichengreen (1993), "Shocking Aspects of European Monetary Integration" in F. Torres and F. Giavazzi (eds.), "Adjustment and Growth in the EMU", Cambridge University Press
- Bayoumi, T. (1994), "A Formal Model of Optimum Currency Areas", IMF Staff Papers, **41**, 537-554
- Bayoumi, T. and E. Prasad (1995), "Currency Unions, Economic Fluctuations and Adjustment: Some Empirical Evidence", CEPR Discussion Paper no. 1172
- Bayoumi, T. and B. Eichengreen (1996), "Operationalizing the Theory of Optimum Currency Areas", CEPR Discussion Paper no. 1484
- Bertola, G. and A. Ichino (1995), "Crossing the River: a Comparative Perspective on Italian Employment Dynamics", *Economic Policy*, **20**, 361-420
- Bryant, R., D. Henderson, G. Holtham, P. Hooper and S. Symansky (1988), "Empirical Macroeconomics for Interdependent Economies", the Brookings Institute, Washington D.C.
- Buti, M., D. Franco and H. Ongena (1997), "Budgetary Policies during Recessions. Retrospective Applications of the 'Stability and Growth Pact' to the Post-War Period", European Commission Economic Papers 121
- Christodoulakis, N., S. Dimelis and T. Kollintzas (1995), "Comparisons of Business Cycles in the EC: Ideosyncracies and Regularities" *Economica*, **62**, 1-27
- Decressin, J. and A. Fatás (1995), "Regional Labour Market Dynamics in Europe", *European Economic Review*, **39**, 1627-1655
- EC Commission, (1995), "The Composition of Unemployment from an Economic Perspective", *European Economy*, **59**, 129-145
- Eichengreen, B. and F. Ghironi, (1997), "How Will Transatlantic Policy Interactions Change with the Advent of EMU?", CEPR Discussion Paper no. 1643
- Eichengreen, B. (1996), "Saving Europe's Automatic Stabilizers", National Institute Economic Review, 92-98
- Giorno, C., P. Richardson, D. Rosevaere and P. van de Noord (1995), "Estimating Potential Output, Output Gaps and Structural Budget Balance", *OECD Economic Papers*, **24**, 166-209
- Goodhart, C. and S. Smith (1993), "Stabilization" in European Commission (1993), "The Economics of Community Public Finance", European Economy, special edition no. 5

- Grauwe. P. de, (1994), *The Economics of Monetary Integration*, Oxford University Press.
- von Hagen, J. (1991), "Fiscal Arrangements in a Monetary Union: Evidence from the US", Indiana University Discussion Paper nr. 58
- von Hagen, J. and G. Hammond, (1995), "Regional Insurance Against Asymmetric Shocks. An Empirical Study for the European Community", CEPR Discussion Paper 1170
- Helg, R., P. Manasse, T. Monacelli and R. Rovelli, "How Much (a)symmetry in Europe? Evidence from Industrial Sectors", *European Economic Review*, **39**, 1017-1041
- Heylen, F. and A. van Poeck (1995), "National Labour Market Institutions and the European Economic and Monetary Integration Process", *Journal of Common Market Studies*, **33**, 573-595
- Italianer, A. and M. van Heukelen (1993), "Proposals for Community Stabilisation Mechanisms: Some Historical Applications", *European Economy*, special edition no.5, "The Economics of Community Public Finance"
- Jackman, R., R. Layard and S. Nickell, (1991), *Unemployment*, Oxford University Press.
- Karras, G. (1996), "Is Europe an Optimal Currency Area? Evidence on the Magnitude and Asymmetry of Common and Country-Specific Shocks in 20 European Countries", *Journal of Economic Integration*, **11**, 366-384
- Krugman, P., (1993), "What Do We Need to Know about the International Monetary System?", *Princeton Essays in International Finance*, Princeton University.
- Manasse, P. (1991), "Fiscal Policy in Europe: the Credibility Implications of Real Wage Rigidity", *Oxford Economic Papers*, **43**, 321-339
- Mc Morrow, K. (1996), "The Wage Formation Process and Labour Market Flexibility in the Community, the US and Japan", *European Commission Economic Papers* 118
- Méltiz, J. and S. Vori (1993), "National Insurance against Unevenly Distributed Shocks in a European Monetary Union", *Recherches Economiques de Louvain*, **59**, 81-103
- Miller, M. and J. Williamson (1988), "The International Monetary System. An Analysis of Alternative Regimes", *European Economic Review*, **32**, 1031-1054
- van der Ploeg, F. (1991), "Macroeconomic Policy Coordination Issues During the Various Phases of Economic and Monetary Integration in Europe", *European Economy*, special edition no.1, "The Economics of EMU"
- Poole, W. (1970), "Optimal Choice of Monetary Policy Instruments in a Simple Stochastic Macro Model", *Quarterly Journal of Economics*, **84**, 197-216
- Sheen, J. (1992), "International Monetary and Fiscal Policy Cooperation in the Presence of Wage Inflexibilities", *Journal of Economic Dynamics and Control*, **16**, 359-387
- Turnovsky, S. (1986), "Monetary and Fiscal Policy under Perfect Foresight: a Symmetric two-Country Analysis", *Economica*, **53**, 139-157
- Viñals, J. and J. Jimeno (1996), *Monetary Union and European Unemployment*. CEPR Discussion

Paper 1485

Weber, A. (1991), "EMU and Asymmetries and Adjustment Problems in the EMS. Some Empirical Evidence," *European Economy*, special edition no.1, "The Economics of EMU", 1991